

*statu pupillari* in public secondary schools above the age of fifteen, able and willing to bear arms, should be enrolled for the purpose of instruction in drill, manœuvre, and the use of arms." At the same time the paper makes it quite clear that the Headmaster of Eton thinks mere proficiency in drill is not sufficient—at every step the boy must be taught the reason of everything he is called upon to do, and throughout his training his intelligence must be carefully and steadily developed. Approaching the same question from another point of view, Prof. Armstrong, in a letter to the *Times*, maintains that no amount of mere military training given in schools, or subsequently, will ensure the necessary improvement in our officers, unless the intelligence of boys is more satisfactorily developed in the early years at schools—an end which can best be secured by an adequate training in the scientific method. It may fairly be surmised that the Headmaster of Eton is quite in agreement with Dr. Armstrong as to the paramount importance of early teaching, and that both are equally anxious that intelligent citizens should somehow be produced. Of the value of a familiarity with the methods of science it is here unnecessary to say anything, but it would certainly appear that both contentions are right. What is wanted is Dr. Warre's intelligent military training for public school boys who have all had the advantage of a training in the scientific method for which Dr. Armstrong pleads.

### SCIENTIFIC SERIALS.

*Transactions of the American Mathematical Society*, vol. i. No. 2, April.—On the metric geometry of the plane  $n$ -line, by F. Morley. The relations which  $n$ -lines of a plane exhibit, when considered in relation to the circular points, have not received, in Prof. Morley's opinion, systematic attention since the important memoirs by Clifford, on Miquel's theorem ("Works," p. 51), and by Kantor (*Wiener Berichte*, vols. lxxvi. and lxxviii.). He applies certain notions which are fundamental in the geometric treatment of the theory of functions, and especially the notion of mapping. The paper is an interesting extension of Clifford's chain, and adds many curious results.—On relative motion, by A. S. Chessin. A memoir extending to 54 pages. The theory developed in it originated in a memoir by Bour in 1863 (*Journal de Liouville*, Ser. 2, vol. viii.). It deals mainly with the so-called "second form" of differential equations of Lagrange, and with the canonical system of differential equations of Hamilton-Jacobi. The first part of the paper deals only with the theory of relative motion. The differential equations are derived from one fundamental principle embodied in the so-called "theorem of Coriolis." This enables the author, not only to write down the differential equations of relative motion immediately from the corresponding equations of absolute motion, but to obtain equations as general as those known for absolute motion. In this first part there are eleven chapters. The second part (promised) is to contain applications of the theory. Among the problems to be discussed is the problem of Foucault's pendulum when the oscillations are not infinitely small, and the problem of Foucault's top, which Gilbert was unable to solve (sur l'application de la méthode de Lagrange à divers problèmes de mouvement relatif). The two problems, our author states, can be easily solved by the theory and formulas given in this first part.—Plane cubics and irrational covariant cubics, by H. S. White.—The paper considers cubics invariant under partial transformation by covariants (2, 2), and those invariant under complete transformation by covariants (3, 3). There remain for further treatment the two sets of conics invariant under the third transformation (2, 2), and invariant curves of order higher than the third (cf. the author's paper in No. 1). The new covariant cubics are eight in number, all of the type called equianharmonics.—A purely geometric representation of all points in the projective plane, by J. L. Coolidge. After some definitions, the writer gives a representation of all points in a real line by lines in a real plane, and then extends the representation so as to include all points in a real plane, noticing in particular those systems of lines which represent points on an imaginary line. He then takes up the subject of chains of points, showing their application to the general theory of projectivity. Finally, he glances briefly at the system of lines which represent points on a real conic, and concludes with remarks as to other possible solutions of the problem and its extension to three dimensions.—The decomposition of the general collineation of space into three

skew reflections, by E. B. Wilson. The paper discusses the question, "Is it possible to decompose the general collineations of space into the product of a number of skew reflections; and if so, what is the least number of skew reflections involved in such a decomposition?"—A new method of determining the differential parameters and invariants of quadratic differential quantics, by H. Maschke, exhibits in a preliminary way a symbolic method in close analogy with the symbolism used in the algebraic theory of invariants, for the construction and investigation of invariants of quadratic differential quantics.—On the extension of Delaunay's method in the lunar theory to the general problem of planetary motion, by G. W. Hill, shows that the tediousness of Delaunay's method disappears when the greatest generality is given to the procedure.—Mr. J. E. Campbell writes on the types of linear partial differential equations of the second order in three independent variables which are unaltered by the transformations of a continuous group.

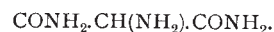
*Bulletin of the American Mathematical Society*, June.—Prof. Cole furnishes an account of the *Proceedings* at the New York April meeting of the Society, and abstracts several of the papers read; and Prof. Holgate performs a like office for the April meeting of the Chicago section of the Society.—J. G. Hagen gives a short sketch of the history of the extensions of the calculus. The abstract is confined to those theories that are in close relation to the infinitesimal calculus and the theory of functions, and excludes geometrical methods and methods of demonstration. To name one or two points discussed, they are Cauchy's "Calcul des Résidues," Schell's "Quotient and Instaural," the exponential function of higher order, the logarithmic methods of Bergbohm and Oltramare, and the extension of the calculus of finite differences.—Reviews are given of Burnside's "Theory of Groups," by Dr. G. A. Miller; of D'Ocagne's "Traité de Nomographie," by Prof. Morley; of Barton's "Theory of Equations," by J. Maclay; of Rice's "Theory and Practice of Interpolation," by Prof. E. W. Brown; of Von Braunmühl's "History of Trigonometry," by Prof. Cajori; of M. Boyer's interesting "Histoire du Mathématiques," by the same writer; and of Frischauf's "Vorlesungen über Kreis- und Kugel-Funktionen-Reihen," by W. B. Ford.—Varied information is supplied in the "Notes" and "New Publications."

The numbers of the *Journal of Botany* for May, June, and July are almost entirely occupied by articles descriptive of new species, or relating to the geographical distribution of plants, chiefly in the British Islands. Mr. H. N. Dixon records the detection of an addition to British mosses in *Amblystegium compactum*, and Mr. S. M. Macvicar an addition to British Hepaticæ, in *Pellia neesiana*.

### SOCIETIES AND ACADEMIES.

#### LONDON.

**Chemical Society**, June 21.—Prof. Thorpe, President, in the chair. The following papers were read.—Researches on morphine, I., by S. B. Schryver and F. H. Lees. Morphine readily exchanges an alcoholic hydroxyl group for halogen, yielding the bases chloromorphine,  $C_{17}H_{18}O_2NCl$ , and bromomorphine; when heated with water these substances give isomorphine,  $C_{17}H_{18}O_3N$ , and on reduction chloromorphine yields desoxymorphine hydrochloride ( $C_{17}H_{16}O_2N, HCl$ ),  $3H_2O$ . These four new bases are not narcotics.—On the oxime of mesoxamide and some allied compounds, by M. A. Whiteley. Nitrosyl chloride converts malonamide into the isonitrosoderivative,  $CONH_2.C(NO).CONH_2$ ; nitrous acid converts the latter into a pseudonitrole,  $CONH_2.C(NO)(NO_2).CONH_2$ , and hydriodic acid reduces it to aminomalonamide,



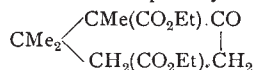
—On dimethyldiacetylacetone, tetramethylpyrone and orcinol derivatives from diacetylacetone, by J. N. Collie and B. D. Steele. Disodiodimethylpyrone and methyl iodide react, giving dimethyldiacetylacetone,  $C_7H_8O_3(CH_3)_2$ , which is converted into tetramethylpyrone,  $C_7H_8O_2(CH_3)_2$ , by hydriodic acid; the residues from the preparation of dimethyldiacetylpyrone contain trimethylpyrone,  $C_8H_{10}O_2$ , and an orcinol derivative,  $C_9H_8O_2$ .—Dehydracetic acid, by J. N. Collie. The author has succeeded in preparing dehydracetic acid from triacetic lactone.—The decomposition of hydroxamidodisulphates by copper sulphate, by E. Divers and T.

Haga.—The degradation of glycollic aldehyde, by H. J. H. Fenton.—Notes on the chemistry of chlorophyll, by L. Marchlewski and C. A. Schunck.—A new series of pentamethylene derivatives, I., by W. H. Perkin, jun., J. F. Thorpe and C.

Walker. Ethoxycaronic acid,  $C(CH_3)_2 \begin{matrix} C(OC_2H_5)CO_2H \\ | \\ CH.CO_2H \end{matrix}$ , is

obtained by treating  $\alpha\alpha'$ -dibromo- $\beta\beta$ -dimethylglutarate with alcoholic potash, and yields *asym*-dimethylsuccinic anhydride,  $\begin{matrix} CMe_2.CO \\ | \\ CH_2-CO \end{matrix} O$ , with sulphuric acid. Ethyl dibromodimethylglutarate and sodiomalonic ether condense, yielding the sodio-derivative,  $CMe_2 \begin{matrix} C(CO_2Et).CNa.CO_2Et \\ | \\ C(CO_2Et).CO \end{matrix}$ ; numerous deriva-

tives of this substance are described.—Experiments on the synthesis of camphoric acid. III. The action of sodium and methyl iodide on ethyl dimethylbutanetricarboxylate, by W. H. Perkin, jun., and J. F. Thorpe. Ethyl dimethylbutanetricarboxylate is converted by sodium and methyl iodide into a substance which possibly has the constitution



which should be easily converted into a substance having the constitution assigned by Bredt to camphoric acid; the ester is converted on reduction into an isomeride of camphanic acid.—The oxyphenoxy- and phenylenoxy-acetic acids, by W. Carter and W. T. Lawrence.—The condensation of ethyl  $\alpha$ -bromoisobutyrate with ethyl malonates and ethyl cyanacetates;  $\alpha$ -methyl  $\alpha'$ -isobutylglutaric acid, by W. T. Lawrence. The author shows that the following general equations hold:—(1)  $CNaRX.CO_2Et + CBrMe_2.CO_2Et = CRX(CO_2Et).CMe_2.CO_2Et + NaBr$ , when the sodio-derivative is solid, and (2)  $CNaRX.CO_2Et + CBrMe_2.CO_2Et = CRX(CO_2Et).CH_2.CHMe.CO_2Et + NaBr$ , when the sodio-compound is dissolved;  $R=H$  or an alkyl group and  $X=CN$  or  $.CO_2Et$ .—Methylisoomylsuccinic acid, II., by W. T. Lawrence.—The estimation of furfural, by W. Cormack. Furfural may be estimated by oxidising it to pyromucic acid by standard ammoniacal silver oxide solution, filtering off the reduced silver and titrating the silver left in solution.—The constitution of hydrogen cyanide, by J. Wade.—Inhibiting effect of etherification on substitution in phenols, by H. E. Armstrong and E. W. Lewis. The substitution of benzoyl, phenylsulphonyl, benzylsulphonyl, the radicle  $C_{10}H_{15}O.SO_2$ , of Reychler's camphorsulphonic acid, or picryl for phenolic hydrogen in phenolpharosalphonic acid renders the substance inert towards bromine.—Bromination of oxyazo-compounds, by H. E. Armstrong and P. C. C. Isherwood.—Metasulphonation of aniline, by H. E. Armstrong and W. Berry.—Phenylacetylchloramine and analogous compounds, by H. E. Armstrong.—Benzylanilinesulphonic acids, by I. Smedley.—Benzeneorthodisulphonic acid, by H. E. Armstrong and S. S. Napper.—An isomeride of furfural, by J. P. Millington and H. Hibbert.—The mono- and di-acetyl and phenacetyl diethyl tartrates, by J. McCrear and T. S. Patterson.

July 5.—Prof. Thorpe, president, in the chair.—The Nilson Memorial Lecture was delivered by Prof. Otto Pettersson, of Stockholm.

Entomological Society, June 6.—Mr. G. H. Verrall, President, in the chair.—Mr. Hedworth Foulkes, B.Sc., and the Rev. H. C. Lang, M.D., were elected Fellows of the Society.—Mr. G. H. Verrall exhibited a species of the genus *Ceratitis*, MacLeay, apparently identical with Bigot's *C. frenicillatus* from the Gold Coast (West Africa), and a very handsome Trypetid reared from the fruit of *Mimusops caffra* by Mr. Claud Fuller at Durban, Natal.—Mr. C. O. Waterhouse exhibited specimens of a Hemipteron, *Aspongopus nepalensis*. They are much sought after by the natives, who use them for food pounded up and mixed with rice.—Mr. Merrifield exhibited a number of pupae of *Apovia crataegi*, and called attention to the want of correspondence between the markings on the pupal and those on the imaginal wing. As might be expected of an insect whose larva pupates by preference on stems screened by foliage, its colour is not very greatly affected by its surroundings; on comparing some which had had yellow or orange surroundings with others which had had dark ones, it was shown that the former tended to yellow

ground colour, and the latter to grey, having also an increase of the dark spots with which the thorax and abdomen are thickly strewn. He also exhibited some enlarged coloured photographs of the green and dark pupal forms of *Papilio machaon*, obtained by causing the larvæ to pupate on green, yellow or orange surfaces, and on dark ones respectively.—Sir G. F. Hampson exhibited specimens of *Oligostigma arcaalis*, from Ceylon, where his correspondent, Mr. J. Pole, had met with a swarm on an island in a river which he estimated at 20,000; when disturbed the buzz made by their wings was quite audible, and after three waves of the net 236 specimens were bottled from round its edges, the net still appearing quite full; as, in the some thirty specimens sent, the sexes were in almost even proportions, this was not a case of male assemblage. He also exhibited cleared wings, showing the neuration of *Diacrisia rursula*, *Tyria jacobaeae*, *Callimorpha hera* and *C. dominula*, and contended that the genus *Callimorpha* should therefore be removed from the *Arctiidae* and placed in the *Hypsidae* where it is closely allied to *Nyctemara*, *Callarctia* and other genera as the fully developed proboscis, the non-pectinate antennæ, the smoother sealing, the more diurnal habit, and the larvæ being scantily clothed with hair all bore out the correctness of this association.—Dr. Chapman exhibited a portion of a stem of *Ferula communis* from Ile St. Marguerite, near Cannes, showing burrows and pupa cases of *Loeopera francillonana*. A number of vacant holes were also visible, being the exit of an ichneumon, which affects a large majority of the Tortrix, believed to be *Chelonus inanis*, Nees.—Mr. F. Enock exhibited living specimens of male and female *Ranatra linearis*, Linn., from Epping, together with the peculiar forked eggs, which he had observed laid by the *Ranatra*, as it rested upon the upper surface of the leaf grasping the edges with its claws. The short anterior legs are held well up close together, in a line with the body, the head raised about an inch from the leaf, while the tip of the abdomen and ovipositor is pressed against the leaf—a downward and forward movement being given. The ovipositor is thus forced through the leaf, then partially withdrawn and the egg extruded and forced into the hole as far as the forked filaments, which prevent it from going right through the leaf.—Mr. H. K. Donisthorpe exhibited cases of *Clythra quadripunctata*, specimens of *Lomechusa strumosa*, with its host *Formica sanguinea*, sent by Father Wasmann from Holland, the insects mounted in the position assumed by the guest and host when the former is being fed by the latter. He also showed *Cossyphodes bewickii*, Woll., a beetle from Cape Colony, with the ants with which it is found—*Pheidola megacephala*, var. *punctulata*, Mayr.—Mr. C. J. Barrett exhibited two females of *Spilosoma mendica* reared by Mr. J. E. Robson, of Hartlepool, tinged with purplish-pink, and ordinary specimens of the same for contrast.—A paper was communicated on life-histories of the Hepialid group of Lepidoptera by Mr. Ambrose Quail, and a note on the habits and structure of *Acanthopsyche opacella*, H. Sch., by Dr. T. A. Chapman.

Zoological Society, June 19.—Prof. G. B. Howes, F.R.S., Vice-President, in the chair.—Dr. Walter Kidd read a paper on the significance of the hair-slope in certain mammals, in which reference was made to previous investigations into the hair-slope on the extensor surface of the human forearm, and its bearing upon Weissmann's doctrine of the non-inheritance of acquired characters. Details were given of further observations as to the hair-slope on the nasal and frontal regions of certain mammals. The ordinary type and the exceptional type of slope were described, and lists of animals conforming to the two types were given. These results were held to be opposed to the doctrines of Weissmann, and to be attributable to the habits of the animals in question.—Mr. F. E. Beddard, F.R.S., read a paper on the anatomy of *Bassaricyon alleni*, based on an examination of a specimen of this mammal which had recently died in the Society's gardens. The result arrived at was that this genus was clearly referable to the family Procyonidae, as had been usually supposed, and allied, especially in external form, to *Cercoleptes*, but distinguished by well-marked characters.—Mr. W. F. Lanchester read the first part of a paper on a collection of crustaceans made at Singapore and Malacca by himself and Mr. F. P. Bedford. It contained a list of the Brachyura comprised in the collection, some notes on the nature of the collecting area, and on the habits of certain of the species, together with descriptions of twelve new forms.—A communication was read from Dr. Einar Lönnberg, of Upsala, on the structure and anatomy of the musk-ox (*Oribos moschatus*). It

contained an account of the development of the horns, descriptions of the hoofs and skull, and a comparison between the skull of the musk-ox and that of the Takin (*Budorcas*).—A communication was read from Mr. A. L. Butler, containing the description of a supposed new species of mountain-antelope from the Malay Peninsula, for which the name *Nemorhoedus swettenhami* was proposed.—The Society then adjourned till November next.

**Mathematical Society, June 14.**—Lord Kelvin, G.C.V.O., President, in the chair.—Three foreign members being present, the chairman requested them to make communications to the Society. This they did. Prof. Klein spoke on the continuation of the edition of Gauss's collected works; Prof. Darboux, "Sur différents problèmes relatifs aux transformations de l'espace et aux déformations finis de la matière et sur leurs rapports avec la théorie des systèmes triples orthogonaux"; and Prof. Poincaré, "Sur quelques théorèmes relatifs à l'analyse situs et sur les propriétés des polyèdres dans l'espace à plus de trois dimensions."—Votes of thanks were passed to them by acclamation.—Prof. Stringham also made a few remarks on a proof by non-Euclidian geometry of the form and directrix property of a plane section of a cone.—Prof. Elliott, F.R.S., communicated some notes on the concomitants of binary quantities.—Lord Kelvin read the titles of the following papers which had been received: Some multiform solutions of the partial differential equations of physical mathematics and their applications, Pt. ii., by H. S. Carslaw; Some quadrature formulæ, by W. F. Sheppard; Extensions of the Riemann-Roch theorem in plane geometry, by Dr. Macaulay; On the invariants of a certain differential expression connected with the theory of geodesics, by J. E. Campbell; On the transitive groups of degree  $n$  and class  $n-1$ , by Prof. Burnside, F.R.S.; The invariant syzygies of lowest order for any number of quartics, by A. Young; Canonical reduction of bilinear forms, Pt. ii., by T. J. Bromwich; The energy function of a continuous medium, by H. M. Macdonald; Note on the representation of a circle by a linear equation, by J. Griffiths.

**Geological Society, June 20.**—J. J. H. Teall, F.R.S., President, in the chair.—On the skeleton of a Theriodont reptile from the Baviaans River (Cape Colony), by Prof. H. G. Seeley, F.R.S. The fossil described in this paper was discovered by Mr. W. Pringle at Ealdon, in the bed of the Baviaans River, a tributary of the Great Fish River. It is now preserved in the Albany Museum. The slab containing it is of hard siliceous sandstone, and is 31 inches long by 10 inches wide. It is split so as to expose a portion of the skull, the vertebral column and ribs as far as the pelvis, the scapula, part of the humerus, the femur, and parts of the tibia and fibula. The tail and left hind-limb, and apparently part of the right fore-limb, are lost, owing to the jointed condition of the rock. The bones have decomposed, and are represented by natural moulds from which a beautiful cast was obtained by means of a jelly mould in the Geological Department of the Natural History Museum, before the specimen was returned to Grahams-town. The remains indicate an animal about 2 feet long, exclusive of the tail, and standing probably about 8 inches high; it was not more than 6 inches wide in the fore part of the body. The animal was of great mobility, capable of easily bending the body, and, by straightening the limbs, of occasionally raising its height to 10 inches or more. It is a new type of Theriodont reptile, contributing important facts to the osteology of the group, and especially in regard to the natural association of the bones. It is possibly to be included in the Cynodontia, from which it differs in characters of the ilium, scapula, and skull.—Fossils in the Oxford University Museum (IV.): notes on some undescribed trilobites, by H. H. Thomas. Two new species of *Dalmania* from the Wenlock Shales and one of *Olenus* from the Shineton Shales of Shropshire are described in this paper. The specimens on which the first species of *Dalmania* is founded were collected by the late Dr. Grindrod at Malvern Tunnel. The species has a strong resemblance to certain varieties of *D. caudatus*, especially those more nearly approaching *D. longicaudatus*; its nearest ally seems to be *D. nexilis*. Among its characters are spines round the head, the height of the head-shield, and the distance between the eyes. The type-specimen of the second species came from the Wenlock Shale of Builth. The Shineton specimen was presented to the Oxford Museum by the Right Rev. Bishop Mitchinson.—On radiolaria from the Upper Chalk at Coulsdon (Surrey), by W. Murton Holmes. The radiolaria described in this paper were contained

in the cavities of two small flints which were thrown out of the new cutting between Coulsdon Station and the new Merstham Tunnel on the L. B. & S. C. Railway. They were probably derived from the zone of *Holaster planus*. After treatment with hydrochloric acid, the material yielded silicified casts of foraminifera as well as radiolaria. The surface of the radiolaria is so much altered by corrosion that specific identification is in most cases impossible. Twenty genera have been recognised, and the organisms appear to belong to forty one species of these genera. A list of the radiolaria is given, accompanied by a short description of each form, and four new species are described. The Discoidea appear to have the predominance, and the species of *Dictyomitra* come next in numerical order.—The Society then adjourned until Wednesday, November 7.

**Linnean Society, June 21.**—Dr. A. Günther, F.R.S., Vice-President, in the chair.—Prof. M. Hartog exhibited and made remarks on flowers of new *Abutilon*-seedlings, recently raised by him, and pointed out the extreme variability shown in the form of many of the leaves.—Dr. O. Stapf exhibited fruits of various forms of *Trapa* from Europe, China and India, and discussed the differentiation of the genus into species.—Mr. Clement Reid, F.R.S., exhibited a series of plum-stones recently found in a drain of the Roman baths, and in a rubbish pit, at Silchester. The species identified were Cherry (*Prunus avium*), Damson (*P. domestica*), Bullace (*P. insititia*), Sloe (*P. spinosa*), and Portuguese Laurel (*P. Lauro-cerasus*). Besides these, there was a large variety of Plum, and a very small Sloe, the species of which had not as yet been precisely determined.—On behalf of Dr. O. St. Brody, Mr. B. Daydon Jackson exhibited a small series of British orchids dried by a new process, by which the flexibility of the plant and the natural colours were in a great measure retained.—Mr. R. Morton Middleton exhibited several rush baskets, plaited ropes and dredgers made from *Rosthovia grandiflora*, Hook. f.; and a crab-catcher and limpet-detacher made from *Berberis ilicifolia*, Forster, all used by the Yahgans south of Beagle Channel, Tierra del Fuego.—Mr. F. Enock exhibited and made remarks upon some living specimens of *Ranatra linearis*, Linn., together with their curious eggs.—A paper by Miss Georgina Sweet, Melbourne, was read, "On the Structure of the Spermidical Glands and associated parts in Australian Earthworms."—Dr. Charles Chilton read a paper on the subterranean Amphipoda of the British Islands, reviewing the known species of the genus *Gammarus*, and giving some account of the "Well-Shrimp" and its distribution in England so far as he had been able to determine it from specimens collected.—Dr. A. B. Rendle, referring to his recently published "Revision of the genus *Najas*" (*Trans. Linn. Soc. 2nd Ser., Bot. vol. v. Part 12*), read a supplementary paper on the same subject, in which he gave additional information gained from a recent examination of specimens in eleven Continental herbaria, particularly those at Paris, Geneva, Vienna and Berlin.—The Society then adjourned until Thursday, November 1.

## DUBLIN.

**Royal Dublin Society, May 16.**—The Earl of Rosse, F.R.S., in the chair.—Mr. R. J. Moss read a paper on the adhesive and other physical properties of copper preparations used in potato spraying.—Dr. W. E. Adeney read a paper, entitled "Studies in the analysis of fresh and salt waters."

June 20.—Sir Howard Grubb, F.R.S., in the chair.—Mr. J. A. Cunningham read a paper, entitled "A contribution to the theory of the order of crystallisation of the minerals in igneous rocks." The author discussed the theory recently published by Dr. J. Joly, F.R.S. (*Sci. Proc. Roy. Dubl. Soc. vol. ix. part 3, No. 20, p. 298*), and then gave additional facts in support of Bunsen's theory, that the order of melting points of the minerals may be inverted by pressure. Mr. Cunningham showed a rough method of arriving at the relative latent heats of the minerals by means of their fusibilities; and proceeded to show how the latent heats might be determined by simple chemical measurements. As an example, in the case of quartz, the specific heats of quartz and amorphous silica are already known, and by measuring the difference of the heats of solution of the two substances in HF, the disengagement of heat in passing from the one form of SiO<sub>2</sub> to the other at any temperature is known. Thus, assuming 1425° C. as the melting point of quartz, the number 135.3 was arrived at as a safe minimum for the latent heat of quartz.—Prof. J. Joly, F.R.S., communicated a

paper on the order of crystallisation of silicates in igneous rocks. Referring to a previous communication, the author has extended the observations of the viscous yield of quartz fibres to a temperature of  $735^{\circ}\text{C}$ . Dealing with finely powdered rock-crystal, it is found that this when wrapped in strong platinum foil and exposed for twenty-four hours in a Bunsen flame, shows unmistakable evidence of softening. The powder is loosely caked, and although the great mass is apparently optically unaltered, the particles which have been pressed against the platinum have adhered and melted into blebs, which cannot be removed by friction. Their examination is effected by a vertical illuminator and high power. Finely powdered quartz placed in the meldometer and exposed for four hours to a temperature between  $1085^{\circ}\text{C}$ . and  $1070^{\circ}$  shows similar evidence of fusion. Finely powdered olivine, augite, hornblende and quartz exposed in the meldometer for two and a half hours to a temperature between  $1105^{\circ}\text{C}$ . and  $1080^{\circ}$  reveal, on subsequent examination, that the evidence of fusion was conspicuously more apparent in the case of quartz. The experiments were repeated in an atmosphere of  $\text{CO}_2$ , as coloration changes thought to be due to oxidation appear on heating in the case of hornblende and olivine. In  $\text{CO}_2$  these changes still appear in less degree. Results otherwise the same as before. The author urges that these results support his view that the softening temperature of the silicates will not be found discordant with the observed normal order of solidification in igneous rocks, but will be found to harmonise with Rosenbusch's law, the depression of the softening point in the scale of temperature being influenced by the amount of silica in combination. On the legitimacy of recent attempts to apply the thermodynamic expression connecting  $dp/dt$  with change of volume in reversible systems, the author points out that calculations based on the change of volume of a crystallised silicate to its glass must give erroneous results, and possibly widely erroneous results, seeing that the glass has never existed in the magma at any time, but the crystal was built up from the molecules diffused in the magma. The withdrawal of the molecules from solution may probably have given rise to a volume-change which cannot be ignored.—Mr. S. R. Bennett read a paper containing the results of actinometric observations of the solar eclipse. By exposing an actinometer at intervals of a few minutes throughout the afternoon of the solar eclipse of May 28, it was found that the actinic power of the sun's rays declined rapidly from 2h. 13m. to 3h. 40m. and then increased more rapidly till 4h. 27m. After this there was a regular decrease due to the approach of evening. The exposure at 2h. 13m. was 50s., at 3h. 40m. it was 101s., and 86s. at 4h. 27m. Curves were plotted to represent these results as well as the corresponding ones deducible from theoretical considerations. The curves representing the eclipse effect as found from observation and from theory (on the assumption that the amount of light received from the sun is proportional to the area of his disc exposed) did not agree. That found from observation indicated a greater amount of light received, in the ratio of 2.3 to 1.6 at 3h. 22m., the moment of greatest phase. No satisfactory explanation of this incongruity was given.—Mr. Charles Martin read a paper on heat-radiation observations made at Dunsink Observatory during the eclipse of May 28.

## EDINBURGH.

**Royal Society, June 18.**—Dr. Burgess in the chair.—Prof. Copeland and Mr. Thomas Heath gave descriptions of the preliminary work, the installation of instruments, and the general character of the observations made by them at the recent eclipse. Mr. Heath's communication gave a particular account of the various operations undertaken in connection with the 6-inch Cooke triple object-glass. This object-glass was constructed so as to bring to one focus both the visual and photographic rays. Tested by the most severe tests the instrument was perfectly achromatic. Four photographs of the corona were taken during totality on plates  $8\frac{1}{2}$  by  $6\frac{1}{2}$  inches. Prof. Copeland manipulated the 40-foot telescope which has already done duty on previous occasions. Mr. Frankland Adams had charge of cameras for taking long exposure photographs, and in the working of these had the valuable assistance of officers of H.M.S. *Theseus*. The navigating officer supplied them with time signals; and by means of beautiful maps, for which they were indebted to the courtesy of the director of the Madrid Observatory, they were able to determine with great

ease and accuracy the latitude and longitude of their station near Santa Pola. The Spanish authorities did everything possible to facilitate their operations; and the members of the expedition experienced nothing but kindness at the hands of the people of the town. Photographs began to be taken 16 seconds before totality, and were continued for 60 seconds after totality. The first contact was observed by Prof. Copeland 10.2 seconds sooner than the time expected, there being a projecting mountain ridge on the limb of the moon which first moved across the sun's edge. The shadow bands which occur just before and just after totality were observed by some of the men of the *Theseus* on a vertical wall which had previously been coated with plaster of Paris.—Dr. Buchan and Mr. Omond reported to the Society the nature of the publication of the Ben Nevis observations. For the satisfactory development of meteorological science it was necessary to publish the continuous daily records, and not merely monthly or weekly means. This was now being done with the Ben Nevis observations, both high-level and low-level; and when the work was completed the meteorologist would be in a position to discuss many problems of the greatest interest and importance. It would require three volumes of the Society's *Transactions* to complete the publication of the observations on the scale that had been determined upon. To meet the expense of publication, the Royal Society of London had voted 500*l.*, and an equal grant had been voted by the Royal Society of Edinburgh.

July 2.—Sir Arthur Mitchell, Vice-President, in the chair.—In a paper on the craniology of the people of India, Part ii, Sir William Turner, F.R.S., described the skulls of the aboriginal hill tribes from the Central Provinces, Chiita, Nagpur, and Orissa. Most of the specimens were in the Indian Museum, Calcutta, but others were in the Anatomical Museum of the University of Edinburgh. They belonged to the so-called Kolarian and Dravidian groups of people. From a comparison of skulls the conclusion was drawn which supported the view advocated by Mr. H. H. Risley from the examination of living persons, that these groups did not differ from each other in physical characters, and that they formed a Dravidian type. A comparison was also made of the Dravidian type of skull with the Australians and the Negritos of the Andaman Islands. Skulls of the Uriya speaking people of Orissa were also described, and the presence of dolichocephalic and brachycephalic types, with skulls of intermediate or mesaticephalic proportions, was shown to occur amongst them.—Sir John Murray and Mr. F. P. Pullar communicated the second part of their bathymetrical survey of the fresh-water lochs of Scotland, in which they dealt with Lochs Chon, Ard, Monteith, and Leven of the Forth drainage area, and with Lochs Ericht and Garry in the Tay basin. These lochs differ greatly in elevation, the extremes being: Monteith, 55 feet above the sea; Ericht, 1152 feet above the sea-level. Their areas vary from 277 acres (Chon) to 4690 acres (Ericht). In this most elevated of the larger lochs of Scotland there are two depressions in which the depth exceeds 300 feet, the maximum depth recorded being 512 feet. The deposits in the deeper parts of all the six lochs consist of a dark brown mud containing much organic matter, but in some there is a second layer, three to six inches beneath the upper layer, of a light brown colour and greater consistency, containing less organic matter. Numerous examples were given of the effect of the wind in driving the warmer surface waters towards the leeward end or side of a loch and in drawing up the colder and deeper layers towards the windward end or side. The shallow lochs were warmer in spring and summer than the deeper lochs, and contained more pelagic life. In these discussions it was important to bear in mind the fundamental difference between temperature and amount of heat. It was calculated that the larger lochs with their much smaller change in temperature really stored up more heat than the smaller lochs with their greater change in temperature.—A note by Dr. R. Sydney Marsden was read, drawing attention to a paper he had read in 1880 (see *Proc. R.S.E.*, 1881), which contained an account of his method for the artificial preparation of diamonds. M. Henri Moissan, of Paris, described in 1893 a method for the preparation of adamantite carbon which differed from Dr. Marsden's method in details which did not seem to be essential. The note was a claim for priority in a matter in which the later experimenter was now getting all the credit in the eyes of the scientific world.

## PARIS.

Academy of Sciences, July 2.—M. Maurice Lévy in the chair.—Communication from M. Darboux concerning the International Association of Academies (p. 249).—Permanent but unequal heating by radiation of a wall of indefinite thickness reduced to the case of an analogous heating by contact, by M. J. Boussinesq.—The combustible gases of the atmosphere; the air of woods and of mountains, by M. Armand Gautier. Following up the experiments, previously described, made with the air of Paris, air was examined in the middle of a pine wood, and on the summit of a mountain away from all vegetation. The ratios of carbon to hydrogen found in the three cases were 3·5 for Paris, 2·2 in the air of woods, and 0·33 in the mountain air, the quantities of hydrocarbons per 100 litres of air expressed as methane being 22·6 c.c., 11·3 c.c., and 2·2 c.c. respectively. It was also found that air taken at a high altitude, collected in a place denuded as far as possible of animals, plants and humus, is nearly entirely free from hydrocarbons, but still contains about 2/10,000,000ths of its volume of free hydrogen.—Synthesis of  $\alpha$ -dimethyl- $\gamma$ -cyanotricarballylic ester and of the corresponding acid, by MM. A. Haller and G. Blanc. Cyanosuccinic ethyl ester is heated with sodium ethylate and  $\alpha$ -bromo-isobutyric acid, and the resulting ester separated in the usual way.—M. Zambaco was elected a correspondent for the Section of Medicine and Surgery.—Occultation of Saturn of June 13 observed with the Brunner equatorial at the Observatory of Lyons, by M. J. Guillaume.—On a prerogative of the Gregorian Calendar, by M. Joseph Lais.—On the method of Neumann and the problem of Dirichlet, by M. A. Korn.—On the motion of a wire in space, by M. G. Floquet.—On the propagation of condensed waves in hot gases, by M. H. Le Chatelier.—On the decomposition of harmonics by the ear, by M. F. Larroque.—On the thermo-electricity of some alloys, by M. Emile Steinmann. Nickel steel containing 28 per cent. of nickel gave an electromotive force against lead of 385 microvolts between 20° and 260° C.—On the true atomic weights of ten elements deduced from recent works, by M. G. Hinrichs. By applying the method previously described by the author to some recent determinations of atomic weights, the latter are made to appear as whole numbers exactly.—Attempt at a general theory of acidity, by M. de Forcrand. The theory put forward allows of the prediction of the acidity of a compound containing hydrogen replaceable by a metal when the formula of constitution is known; and also of the heat of fusion when this cannot be determined directly.—Addition of hydrogen to acetylene and ethylene in presence of finely divided platinum, by MM. Paul Sabatier and J. B. Senderens. A mixture of hydrogen and acetylene, the former being in excess, when passed over platinum black reacts vigorously, ethane together with a little ethylene being produced, the secondary products noticeable with nickel being practically absent. With acetylene in excess, ethylene is the chief product, although ethane is still produced in notable quantities. Working at 180° instead of at ordinary temperatures the reaction becomes more vigorous, but the quantity of secondary condensation products increases.—On the methoxy-hydratropic acid obtained by the oxidation of anethol. Identity of phloretic acid and of hydropara-coumaric acid, by M. J. Bougault.—Method for preparing synthetically higher homologues of acetolacetic ester and acetylacetone, by M. L. Bouveault. By the interaction of acetoacetic ether and the fatty acid chlorides, the  $\beta$ -ketoic ethers and  $\beta$ -diketones are easily obtained.—On the mode of formation of the compounds  $[C_2H_2(Cu_2Cl_2)KCl]$  and  $C_2H_2[(Cu_2Cl_2)_2KCl]$ , by M. Chavastelon.—On the metallic compounds of diazoamido-benzene, by M. Louis Meunier.—Action of nitric acid upon trichlor-guaiacol, by M. H. Cousin. The action of nitric acid upon the trichlor-derivative is quite different from that of the tetrachlor- and tetrabromo-derivatives as instead of the orthoquinones produced in the latter case, a complicated condensation product is produced.—On the aloins, by M. E. Léger.—Solubility of cupric chloride in organic solvents, by M. Geschner de Coninck.—On the composition of the albumin of the seed of *Gleditschia triacanthos*, by M. Maurice Goret. The reserve hydrocarbon in this case is a mannogalactane; hydrolysis yielding only a mixture of mannose and galactose.—Hermaphroditism and parthenogenesis in the Echinoderms, by M. C. Figuer.—Study of the digestive apparatus of *Brachytrupes achatinus*, by M. L. Bordsas.—Prehnite considered as a constitutive element of metamorphic limestones, by M. A. Lacroix.—On the combinations of the nucleins with metallic compounds, alkaloids and toxins, by M.

H. Stassano.—The power of selective coloration by methylene blue, possessed by living spore-bearing filaments of *Spirobacillus gigas*, by M. A. Certes.—A preventive remedy against the mannite disease of vines, by M. P. Carles.

## CAPE TOWN.

South African Philosophical Society, June 6.—L. Périn-guey, President, in the chair.—Mr. W. L. Sclater exhibited a series of photographs of birds and their nests taken by Mr. R. H. Ivy, in the neighbourhood of Grahamstown.—Dr. J. D. F. Gilchrist exhibited:—(1) A Gadoid fish, belonging to the genus *Haloporphyrus* and probably a new species, found by the Government steamer in trawling about 40 miles off Cape Town, in over 100 fathoms. (2) Four fishes showing luminous organs, viz.: a *Monocentris* from shallow water, Mossel Bay; an *Argyrolepeus*, a *Paraliparis* and a *Scopelus* from over 100 fathoms off the Cape Peninsula, probably all new species. (3) A number of new Alcyonarians which have been procured by the Government steamer and described by Prof. Hickson, F.R.S. These included the new genus, *Acrophytum claviger*, and three new species—*Heteroxeima capensis*, *Sarcophytum trochiforme*, *Gorgonia capensis*. (4) Specimens of *Veritillum* illustrating the difference in size of the fauna of the east and west coasts of Africa, the eastern forms being larger than those from the west coast. (5) A specimen of *Agriopus torvus*. (6) A new species of Anchovy from East London, this being the second species of the genus *Engraulis* discovered in South African waters.—Dr. F. Purcell exhibited specimens of all the known South African species of Peripatus, including, in addition to the three previously described forms, four others recently described by himself in the annals of the museum, making seven in all. Dr. Purcell in his remarks on the genus maintained that the supposed great antiquity of Peripatus was very doubtful, depending as it did on the supposition that the tracheæ of the tracheate Arthropods could only have originated once, for it is now known that true tracheæ have originated independently in at least three different ways, for instance, in two ways in spiders and in a third way in insects. It would be reasonable to suppose, therefore, that Peripatus may also have acquired its tracheæ independently of those of the insects.

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